

Date: October 2, 1969

From:

Re:

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The program for the Fall, 1969 meeting of the Optical Society describes a paper by the above named author entitled "Stereoscopic perception with single transparencies". The text of the abstract is as follows:

Single photographic transparencies are shown to produce stereoscopic perception of the recorded scene when displayed with an optical system that produces binocular image disparity by differential illumination and differential aberrations of the image. The optical system is described. The contribution of factors like degree and nature of image disparity, familiarity cues, image-focusing cues, color, illumination, sharpness, and orientation of contours on the observed stereoscopic effect is surveyed. The proportion of pseudoscopic to true stereoscopic vision of the recorded image and the stereoscopic information content of the single image is discussed.

STAT [ ] explained in a phone conversation that this phenomenon occurs naturally in a standard 35 mm color slide viewer made by [ ] He stated that other viewers did not show this phenomenon. Rather, the imperfections of the [ ] viewer namely, the imperfectly diffusing screen and a concentrated light source are essential factors. He could not give more details regarding the viewer except that it was about the size of a desk telephone, was automatic, has a magnifier on the left, and costs [ ]

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STAT The phenomenon of "depth" is produced when one observes a single color (black and white have not been tried) slide binocularly. There is a description of this technique which Schwartz claims is not accurate in the latest issue of Applied Optics.

STAT [ ] promised to send me the copy of a paper that he is preparing for Applied Optics describing the technique in detail.

My impression was that this technique does not represent true stereoscopic depth. Rather, the viewing conditions apparently enhance the vividness of the "plastic" depth phenomenon which is favored by conditions inherent in 35 mm viewers, i.e., eye at the ortho position, color, exclusion of cues to flatness, etc. (for a complete description see Schlosberg, H., "Stereoscopic depth from single pictures", American Journal of Psychology, 54, 601-605, 1941). Although this effect can be quite vivid, it does not involve true stereoscopic depth. Rather, the basis is a maximization of the effectiveness of monocular cues.

STAT From what I know at this stage, I would judge that this would be of little interest to the sponsor but will reserve final decision until I have seen the [ ] manuscript.

Declass Review by NIMA/DOD

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1) I contacted [redacted] regarding stereo screen displays. He expressed the opinion that there has been nothing developed in addition to the well known traditional systems and feels that [redacted] is still the best bet for producing stereo on a screen display. He added that [redacted] has analyzed distortion which arises from off-axis viewing of [redacted] displays in an article in the Journal of Motion Picture Engineers. He feels that the main technique not involving goggles, i.e., the use of vertical plastic columns, is simply not worth the effort.

I asked specifically whether there is any way of utilizing temporal variation in the stimulus to produce a 3-D effect. He pointed out that many years ago [redacted] had made a claim that with proper temporal patterning, one could achieve stereo without the use of auxillary optical aids. [redacted] tried this technique himself and concluded that it is a "fraud". (I will try to find the original article.)

[redacted] is a very approachable individual who came to academic life recently after having spent most of his career with the [redacted]. He is an authority on monocular vision, particularly the phenomenon of rivalry.

2) The interpreter validation materials accumulated at the Lowry AFB laboratory by [redacted] have been sent to me at [redacted] rather than to Dr. V. AS requested. They consist of a medium size carton weighing approximately 40 lbs. The previous materials were sent to Dr. V. I will await your word on the disposition of the second shipment.

3) During our recent meeting, Mr. N. raised the question regarding the resolution value of black and white as opposed to color. This was an amazingly unresearched topic until quite recently. In '67 or '68, [redacted] published a paper in Science on color acuity which was the first (with the exception of an internal paper at [redacted] and therefore automatically the authoritative paper in this field. More recently, [redacted] and [redacted] have been concerned with color discrimination at the border independent of intensity differences (also reported in Science). Both of these papers are relevant to N's problem. If interest in this matter is still current, I would suggest that we look up the articles followed by, if necessary, a call or visit to [redacted]

**Comments on a Proposal for "The Use of Peripheral Vision  
in Observing Real-Time Displays"**

I am very much in sympathy with and enthusiastically support the principal rationale of this proposal. Workers in vision and perception, both basic and applied, have overemphasized the functional role of the fovea while neglecting the periphery. I strongly feel that there is tremendous potential in the use of the peripheral visual field particularly in relation to the kinds of problems with which the potential sponsors of this proposal are concerned.

As an outsider with only casual acquaintance with the writers of the proposal, I found it difficult to evaluate their background with respect to the present problem. No data regarding previous work or capabilities are given. Another clue which was unavailable would have been the extent to which the current literature was referenced, but no bibliography was given. In this respect, I should like to call the attention of all concerned to a report entitled "Peripheral Vision Displays",

June, 1967. This research is similar in concept to the present proposal and contains an excellent literature summary and a bibliography of 122 items. A summary of this research was published as "Displays for Seeing without Looking", December, 1966. The authors should also be familiar with the work of

Experiment I. The proposed research strikes me as being potentially profitable. The authors stress the differences between rod and cone vision. My own preference would be to talk about the size of the functional visual field in terms of the concept that, under the proper conditions, larger and larger areas of the visual field are utilized for processing information. However, the end result is the same since one is interested in determining whether the peripheral regions, be they rods, cones, or a combination of both, can be utilized more effectively in order to reduce the relatively inefficient eye movements required for exclusively foveal fixation. In this respect, the experiments are particularly worth while and I have a feeling the results will be of value.

I should point out that there are other methods of increasing peripheral awareness. We have had great success with simple feedback, i.e., the subject is informed when and where a peripheral signal is missed.

A number of precautions will be necessary in the conduct of such an experiment. For example, if one wishes to separate rod from cone vision, then blue light must be used. However, blue light introduces approximately 1 diopter of near-sightedness so this factor must be accounted for in the design of the apparatus. In addition, use of the peripheral visual field has been shown to be subject to learning, so care must be taken to introduce enough trials into the experiment to reflect the results of the learning process.

In order to avoid confusion, it should be noted that the ordinary luminance scale is calibrated for cone vision only. Thus, equal foot-Lamberts will appear unequal to the rods by virtue of their greater sensitivity. It will be of great help in the interpretation of the results if some care were given to the specification of luminance values.

In the proposal, a familiar misinterpretation of the difference between rod and cone vision has been repeated. In fact, the rods and cones are equally sensitive to red light, while for blue light the rods are approximately a thousand times more sensitive than are the cones. Thus, for red light all receptors will respond equally, while for blue light the magnitude of the rod response will be much greater.

Since Experiment II depends in part on the results of Experiment I, few details are given. My comments should be interpreted as applying to Experiment I only.

In summary, I feel that the general purpose of the proposal is worth while and that the authors have directed their interest toward an area of great potentiality. Too little information is given in the proposal to judge the competence of the unnamed investigators, but the general nature of the present proposal suggests that they are sophisticated regarding the potentialities of peripheral vision. It would be helpful if the investigators had an opportunity to look more closely at the literature and to familiarize themselves with some of the special problems which arise in human vision research, particularly with respect to photometry and physiological optics.



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